# United States Patent

[11] 3,629,912


[72] Inventor **Edward M. Klopp**
**Seville, Ohio**



[21] Appl. No. **27,817**
[22] Filed **Apr. 13, 1970**
[45] Patented **Dec. 28, 1971**



[73] Assignee **The Chemical Rubber Co.**
**Cleveland, Ohio**


[54] **CLAMP AND METHOD OF MAKING SAME**
**11 Claims, 14 Drawing Figs.**


[52] **U.S. Cl.** ..... **24/255 SL,** 24/84 H
[51] **Int. Cl.** ..... **A44b 21/00**
[50] **Field of Search** ..... 16/87.2; 24/258, 255, 248, 84, 137, 137 A, 255 SL



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,526,934 | 9/1970 | Owen | 24/81 CC |
| 2,933,790 | 4/1960 | Hudson | 24/255 P X |
| 2,988,314 | 6/1961 | Urich | 24/137 X |
| 2,519,987 | 8/1950 | Wernette | 24/137 |
| 3,043,902 | 7/1962 | Klein | 24/137 X |
| 104,654 | 6/1870 | Searles | 24/137 A UX |

FOREIGN PATENTS

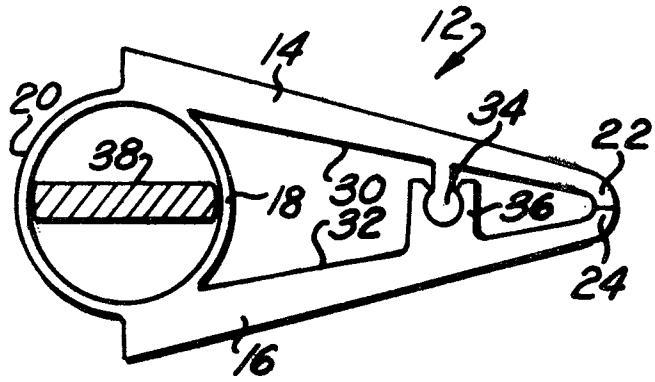
| | | | |
|---|---|---|---|
| 448,953 | 4/1968 | Switzerland | 24/137 A |



*Primary Examiner*—Donald A. Griffin
*Attorney*—Yount and Tarolli



**ABSTRACT:** A one piece, plastic clamp formable from extruded stock. The clamp comprises a pair of lever arms merged toward one end through an integral bight portion, to form a generally U-shaped member. Releasably locking fulcrum means are positioned between the free and merged ends of the lever arms. The releasably locking fulcrum extends the full width of the clamp. The cross section of the clamp through every plane perpendicular to the extrusion axis is identical in every essential respect.

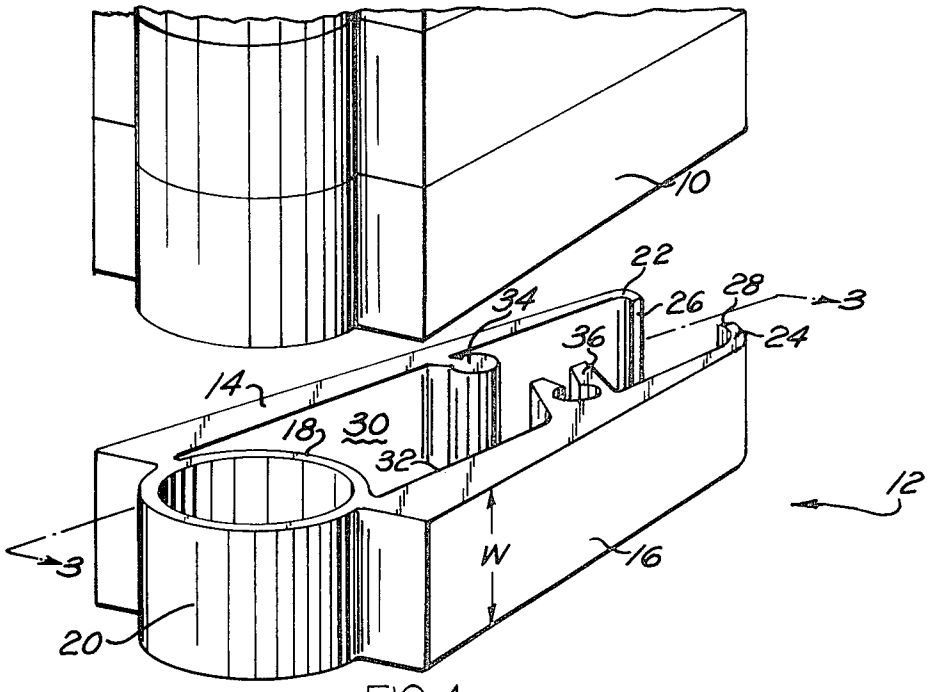



FIG. 1

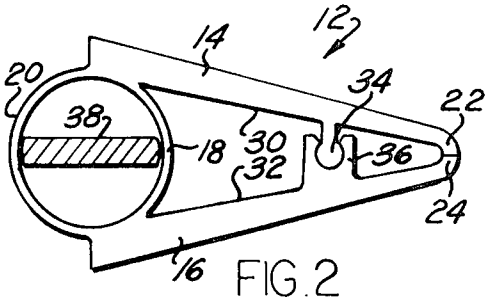



FIG. 2

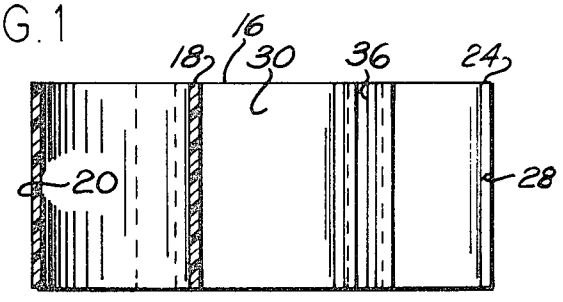



FIG. 3

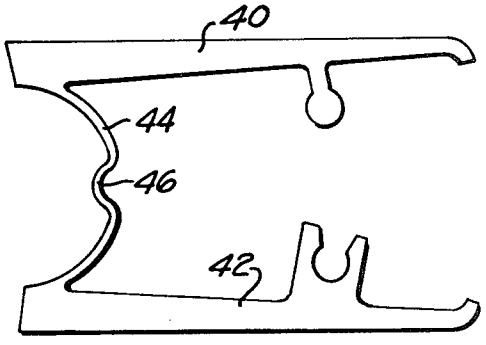



FIG. 4

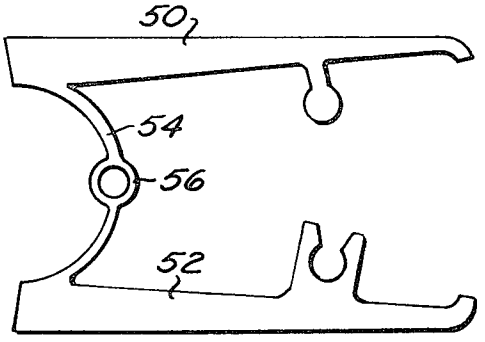



FIG. 5

INVENTOR
EDWARD M. KLOPP

BY Yount and Tarolli
ATTORNEYS

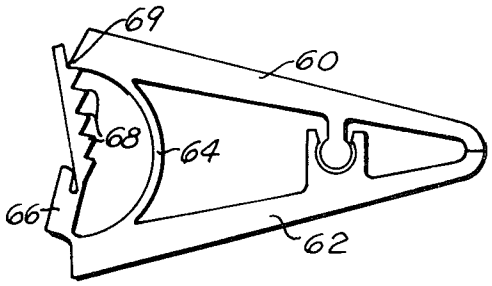



FIG. 6

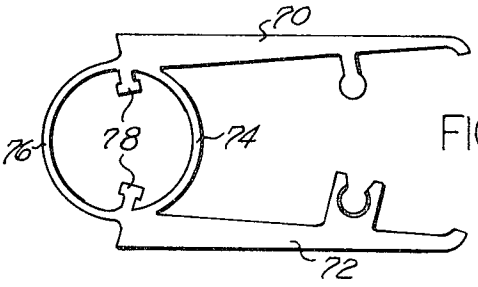



FIG. 7




FIG. 8




FIG. 9

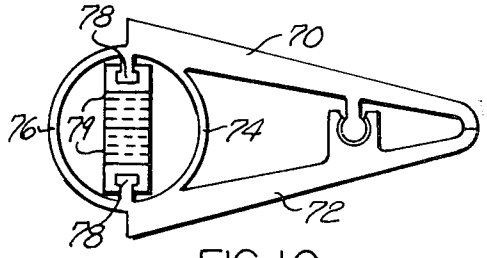



FIG. 10

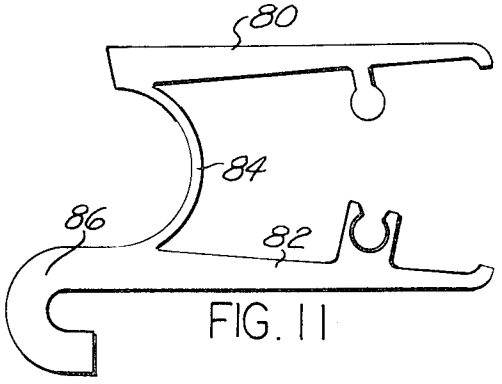



FIG. 11

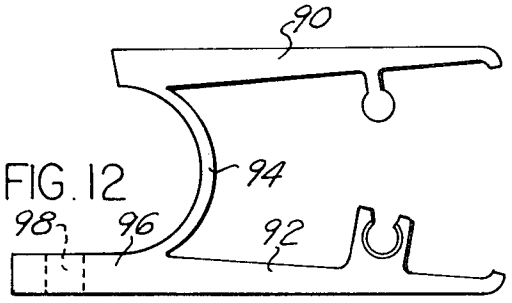



FIG. 12

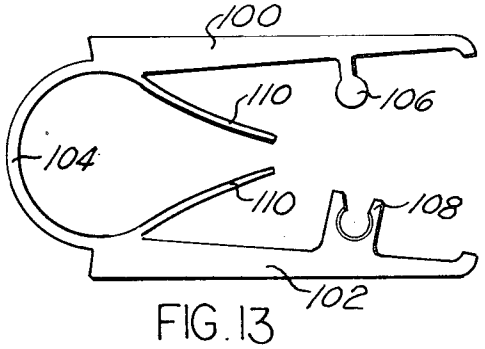



FIG. 13

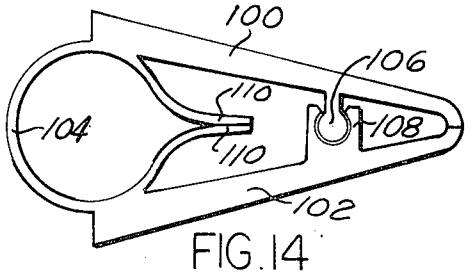



FIG. 14

INVENTOR
EDWARD M. KLOPP

BY Yount and Tarolli
ATTORNEYS

# CLAMP AND METHOD OF MAKING SAME

This invention relates to the clamp art and, more particularly, to one piece, resilient plastic clamp.

Clamps of the type contemplated by the present invention are widely used in industrial, scientific and domestic applications. For example, in the industrial area, such clamps are used in electroplating and pickling operations where small parts held by clamps are dipped into treating baths and then retrieved. In the scientific area the clamps find utility in chromatography to fasten chromatograms to antisyphoning and holding rods, as well as in X-ray and photographic applications, as film viewing clips. In the domestic area, the clamps find utility used as clothes pins and curtain and drapery hardware.

While one piece plastic clamps are known to the prior art, they have heretofore been manufactured by molding, casting or stamping operations. These procedures are relatively costly, particularly when it is recognized that every time a change in dimension of the clamp is desired, a substantial capital investment in new tooling, dies and the like must be made.

Another disadvantage of the prior art one piece plastic clip is in the design of the fulcrum portion of the clamp. Heretofore the fulcrum portion has been formed either as an integral web or as a small snap pin. The integral web type of fulcrum suffers the disadvantage of of being difficult to manipulate and susceptible to early failure through fatigue cracking. The snap pin type of fulcrum, because of its small diameter, constitutes a stress concentrating member and is also susceptible to early failure. In addition, the snap pin permits lateral rotation between the gripping jaws of the clamp, and this complicates manipulation of the clamp.

The present invention overcomes the problems and disadvantages attendant prior art clamps and method of manufacturing. From the structural standpoint, the clamp of the present invention is provided with a releasable locking fulcrum which extends the entire width of the clamp. This overcomes the disadvantages of both the prior art fulcrums as described above.

From the standpoint of method of manufacturing, clamps according to the present invention can be manufactured by a plastic extrusion process. This permits clamps having different widths, with parallel and nonparallel sides, to be manufactured without any additional capital investment to accomplish these modifications.

In addition to obviating certain disadvantages or prior art clamps, the novel clamp of the present invention provides certain additional features which are regarded as entirely new in the art. One of these relates to the provision of means for releasably locking the arms of the clamp against pivotal movement so that the article being clamped cannot be accidentally dislodged. Another relates, in certain embodiments of the present invention, to the provision of novel means defining rests for supporting members for the clamps.

In accordance with one aspect of the present invention, there is provided a one piece clamp comprising a pair of cooperating arms having facing surfaces. The arms interconnect at one end and terminate in opposed gripping surfaces at their other ends. The clamp is provided with pivot means formed integrally with the facing surfaces and disposed intermediate the ends of the arms. The pivot means is operative to translate a bending force applied to the arms, between it and the interconnected ends of the arms, into relative movement between the gripping surfaces. The cross section of the clamp through every plane perpendicular to the plane of the facing surfaces is identical in every essential respect.

In accordance with another aspect of the present invention, there is provided a one piece plastic clamp, formable from extruded stock, comprising a pair of lever arms of finite width merged toward one end through an integral bight portion, to form a generally U-shaped member. The lever arms have free ends terminating in opposed gripping surfaces. The clamp is provided with elongated connecting means formed integrally with and disposed intermediate the ends of one of the lever arms, the connecting means extending the full width of the lever arms, and facing in the direction of the other lever arm. Complementary connecting means are formed integrally with and disposed intermediate the ends of the other lever arm, the complementary connecting means extending the full width of the other lever arms, and facing in the direction of the first mentioned lever arm. The connecting means and complementary connecting means are dimensioned and positioned for locking registry with each other, thereby operating as a fulcrum for bending moments applied to the lever arms.

In accordance with still a further aspect of the invention, there is provided a one piece plastic clamp formable from extruded stock comprising a pair of longitudinally extending lever arms of finite width with each of said lever arms having a free end defining opposed gripping surfaces, the longitudinal axes of said lever arms in the free formed state thereof converging outwardly in a direction away from the free end of said lever arms, said clamp further including an integral bight portion interconnecting the lever arms intermediate the length thereof, and complementary connecting means positioned on each of said arms between said bight portion and said free ends with said complementary means being oriented on their respective lever arms such that in the free state of said lever arms the central axes on which said complementary means are formed converge and intersect inwardly of said lever arms.

It is therefore an object of the present invention to provide an improved one piece plastic clamp.

Another object of the present invention is to provide a clamp of the type described which overcomes a certain deficiency of prior art clamps.

A further object of the present invention is to provide a one piece plastic clamp formable from extruded stock.

Another object of the invention is to provide a one piece plastic clamp having releasable locking fulcrum means extending the entire width of the clamp.

A further object of the invention is to provide a clamp of the type described comprising means for releasably locking the clamping arms against pivotal movement.

These and other objects and advantages will become apparent from the following detailed description of preferred embodiments of the invention when read in connection with the accompanying drawings, in which:

FIG. 1 is a schematic perspective view of a clamp together with a fragmentary portion of an extruded member from which the clamp is severed;

FIG. 2 is a schematic plan view of the clamp illustrated in FIG. 1, with the fulcrum in its locked position;

FIG. 3 is a schematic section view taken generally along line 3—3 of FIG. 1;

FIG. 4 is a section plan view of a modified embodiment of the invention;

FIG. 5 is a schematic plan view of another modified embodiment of the invention;

FIG. 6 is a schematic plan view of another modified embodiment of the invention;

FIG. 7 is a schematic plan view of another modified embodiment of the invention;

FIG. 8 is a schematic end view of a portion of the locking mechanism used in conjunction with the embodiment of FIG. 7;

FIG. 9 is a schematic end view taken along line 9—9 of FIG. 8;

FIG. 10 is a schematic plan view of the same embodiment illustrated in FIG. 7, showing the locking blocks installed and the fulcrum in its locked position;

FIG. 11 is a schematic plan view of a modified embodiment of the invention;

FIG. 12 is a schematic plan view of another modified embodiment of the invention;

FIG. 13 is a schematic plan view of another modified embodiment of the invention; and,

FIG. 14 is a schematic plan view, similar to FIG. 13, but with the clamp fulcrum in its locked position.

Referring now to the drawings wherein the showings are for the purpose of illustrating preferred embodiments of the invention, and not for the purpose of limiting same, FIG. 1 illustrates extruded plastic stock member 10 from which has been severed a one piece plastic clamp designated generally as 12.

With reference to FIGS. 1 through 3, it will be seen that clamp 12 comprises a pair of lever arms 14, 16 of finite width W. While the width W is shown as being constant in the drawings, it will be appreciated that the width may be tapered if desired. Arms 14, 16 are merged toward one end through an integral bight portion, which in this embodiment is defined by resilient, curvilinear element 18, bowed convexly in the direction of free ends 22, 24 of the lever arms, and second resilient curvilinear element 20, bowed convexly in the direction away from the free ends of lever arms 14, 16. Curvilinear elements 18, 20 complement each other in forming a bight portion of generally orbicular configuration.

Free ends 22, 24 of the lever arms terminate in opposed gripping surfaces 26, 28 respectively, which serve to engage opposite surfaces of the article to be held by the clamp.

Arms 14, 16 are provided respectively, with facing surfaces 30, 32. Integrally formed on facing surface 30 is elongated connecting means, which in the embodiment illustrated is defined by rodlike member 34, which extends the full width of lever arm 14. Integrally formed on facing surface 32 is complementary connecting means, which in the embodiment illustrated is defined by elongated socket 36, which extends the full width of lever arm 16. As best illustrated in FIG. 2, rodlike member 34 and socket 36 are dimensioned and positioned for locking registry with each other.

It is noteworthy that the cross section of clamp 12 through every plane perpendicular to the plane of facing surfaces 30, 32 is identical in every essential respect. This feature permits clamps of varying widths to be severed from extruded member 10.

The method of forming plastic clamps, in accordance with the present invention, comprises the steps of extruding a plastic material along a first axis in the form of a member having a generally U-shaped cross section, and thereafter severing a section from the member through a plane rotated a sufficient number of degrees from the extrusion axis so that the section defines a plastic clamp. As illustrated in FIG. 1, a plastic material has been extruded by conventional means not illustrated and forming no part of the present invention, along a generally vertical axis, in the form of member 10 having a generally U-shaped cross section. By means not shown, but well known to those skilled in the art, a section of member 10 has been severed through a plane generally perpendicular to the extrusion axis, forming plastic clamp 12.

It will be appreciated that the plastic clamp may be formed by severing a section of member 10 through a plane rotated more or less than the 90° illustrated in the drawings. In either of these events, there will be provided a plastic clamp having a width which tapers along the length of lever arms 14, 16. These arms may be wider at their connected ends than at their free ends, or vice versa. Those skilled in the art will appreciate that even if rotated 90°, the plane need not be perpendicular to the extrusion axis. It is also within the contemplation of the invention to sever a section from the extruded member though a pair of parallel planes rotated more or less than 90° from the extrusion axis. These planes may but need not be perpendicular to the extrusion axis.

Synthetic organic resins which may be extruded to form plastic clips in accordance with the present invention include a wide variety of thermoplastic resins. Thermosetting resins, for example certain polyester resins, may also be used. Among the useful thermoplastic resins are included certain polyamides, polycarbonates, high density polyethylenes, vinyl polymers and copolymers, polypropylene, and ABS (acrylonitrile-butadiene-styrene) resins. Of these materials, polypropylene resins are preferred because the cured plastics formed therefrom have excellent properties including virtual immunity to flex fatigue, exceptional resistance to environmental stress cracking, and outstanding resilience and memory properties.

Member 10 is preferably extruded in the form illustrated in FIG. 1, that is with arms 14, 16 slightly spread apart, and rodlike member 34 and socket 36 disengaged. It will be noted that the longitudinal axes of the arms 14, 16 in the free formed state thereof converge outwardly in a direction away from the free end of such arms. Moreover, it is to be noted that the central axes of the rodlike member 34 and socket 36 converge and intersect inwardly of the lever arms. After a section member 10 is severed, the resulting clamp may be formed by forcing rodlike member 34 into socket 36. This is accomplished by pivoting the arms 14, 16 about the midpoint of the integral bight portion which brings the longitudinal axes of the rodlike member 34 and socket 36 into alignment, thereby permitting the coupling of the two arms. The clamp is then ready for use.

Depending upon the use to which the clamp is put, it may be desirable to suspend the clamp from a support member, with free ends 22, 24 of arms 14, 16 facing downwardly. In the embodiment illustrated in FIG. 2, the support member 38 may be threaded into the open space defined by complementary curvilinear elements 18, 20. With support member 38 dimensioned as indicated, and clamp 12 rotated so that free ends 22, 24 face downwardly, it will be seen that the support member will resist movement of arms 14 and 16 toward each other. This effectively prevents free ends 22, 24 from inadvertently releasing the article held between them. With the clamp rotated, as illustrated in FIG. 2, it will be seen that arms 14, 16 can be moved toward each other so that in this position the article being clamp can be readily released by movement of free ends 22, 24 away from each other.

FIG. 4 shows a modification of the present invention wherein a plastic clip is defined by a pair of lever arms 40, 42 merged toward one end through an integral bight portion defined by curvilinear element 44. Element 44 is provided with means defining a rest for a clamp supporting structural member, which in the embodiment illustrated, takes the form of a section of reverse curvature 46. This embodiment is well adapted to be supported by a structural member generally circular in cross sections, having a radius of curvature approximating that of section 46. When the clamp is so supported, the combined weight of the clamp and the article held by the clamp tend to flatten curvilinear element 44, and this in turn applies outwardly directed forces against the merged ends of arms 40, 42. This causes the article held by the clamp to be gripped even more tightly by the free ends of the arms.

FIG. 5 illustrates another embodiment of the invention wherein arms 50, 52 are merged at one and through a bight portion defined by curvilinear element 54 having means defining a rest for a clamp supporting structural member in the form of aperture 56. This embodiment is well adapted for use where it is desired to thread one or more clamps on a cylindrical supporting member and limit removal of the clamps to lateral displacement past the end of the support member.

FIG. 6 illustrates another embodiment of the invention wherein a clamp is defined by a pair of arms 60, 62 merged at one end through a bight portion defined by curvilinear element 64. This embodiment provides means for releasably locking lever arms 60, 62 against pivotal movement. This last mentioned means is defined by member 66 formed integrally with lever arms 62, the member being provided with a plurality of saw teeth 68 adapted to engage projection 69 on lever arm 60. With proper dimensioning, engagement of one of the saw teeth 68 with projection 69 will cause curvilinear element 64 to flatten out slightly, forcing interconnected ends of arms 60, 62 away from each other. This, in turn, will increase the pressure applied by the free ends of arms 60, 62 to opposed surfaces of the article being held by the clamp.

FIGS. 7 through 10 show another embodiment of the invention wherein a clamp is formed by a pair of lever arms 70, 72 merged toward one end through an integral bight portion defined by curvilinear elements 74, 76 describing a generally orbicular opening. As best seen in FIG. 7, T-bar extrusions extend inwardly from the points of merger of arms 70, 72 with curvilinear elements 74, 76. Stepped blocks 79, illustrated in

FIGS. 8 and 9, are each provided with a channel dimensioned to receive T-bar extrusions 78. A snug fit is preferred. FIG. 10 shows stepped blocks 79 assembled on T-bar extrusions 78. Forcing the lower steps in one block into engagement with the lower steps of the other block, will cause curvilinear elements 74, 76 to flatten out slightly, which, in turn, forces the integrally interconnected ends of arms 70, 72 away from each other. This causes the free ends of arms 70, 72 to apply increased pressure to the opposed surfaces of an article held by the clamp.

FIG. 11 shows another embodiment of the invention wherein a clamp is formed by a pair of arms 80, 82 merged at one end through an integral bight portion defined by curvilinear element 84. In this embodiment, the merged end of arm 82 extends beyond the bight portion and means are provided on the extension for supporting the clamp with respect to a support member. In the embodiment illustrated in FIG. 11, the last mentioned means takes the form of J-hook 86.

FIG. 12 illustrates another embodiment of the invention wherein a clamp is defined by a pair of lever arms 90, 92 merged toward one end through an integral bight portion defined by curvilinear element 94. Here, lever arm 92 extends beyond the bight portion, as shown at 96. The extension 96 is provided with means for supporting the clamp with respect to a support member, which means in the embodiment illustrated is defined by aperture 98 which extends through the thickness of extension 96.

FIGS. 13 and 14 illustrate another embodiment of the invention wherein a clamp is defined by a pair of lever arms 100, 102 merged toward one end through an integral bight portion defined by curvilinear element 104, bowed concavely in the direction of the free ends of the arms. Fulcrum means are provided by rodlike member 106 and socket 108 both of which extend the full width of arms 100, 102 respectively. In FIG. 13 the fulcrum means is shown disengaged, and in this configuration illustrates the profile which may be taken by the extrudate from which the clamp is formed. In FIG. 14 the clamp is shown in its assembled position, ready for use.

As best seen in FIG. 13 the clamp is provided with auxiliary spring means which in the embodiment illustrated take the form of cantilever leaf springs 110 which extend inwardly from the merged ends of arms 100, 102. The leaf springs extend the full width of the clamp, and taper toward their free ends. The reason for the tapering can best be explained in conjunction with FIG. 14. With rodlike member 106 locked in socket 108, the free ends of leaf springs 110 engage applying normal outwardly directed forces against merged ends of arms 100, 102. When an inwardly directed pressure is applied against the merged ends of arms 100, 102, the area of contact between leaf springs 110 increases. As a consequence of the leaf springs being tapered the stiffness of the springs increases as more pressure is applied to arms 100, 102. The last increment of area contact between the leaf springs is represented by an incrementally thicker cross section of leaf spring than the next preceding increment of area contact. It follows that the thicker the article being gripped between the facing surfaces of the free ends of arms 100, 102, the greater the gripping force.

The present invention has been described in conjunction with certain structural embodiments. However, it will be appreciated that various structural changes may be made in the illustrated embodiments without departing from the intended scope and spirit of the present invention.

Having thus described my invention, I claim:

1. A one piece plastic clamp formable from extruded stock comprising a pair of longitudinally extending lever arms of finite width merged toward one end through an integral bight portion to form a generally U-shaped member, the longitudinal axes of said lever arms in the free state thereof converging outwardly in a direction away from said free ends, complementary connecting means formed integrally with and disposed intermediate the ends of said lever arms, each of said connecting means extending the full width of its lever arm and facing in the direction of said other lever arm, each of said complementary means being formed on axes which, in the free state of said lever arms, converge and intersect inwardly of said lever arms.

2. The clamp as defined in claim 1, wherein said integral bight portion comprises a resilient, curvilinear element bowed convexly in the direction of the free ends of said lever arms.

3. The clamp as defined in claim 2, wherein said curvilinear element comprises means defining a rest for a clamp supporting structural member.

4. The clamp as defined as claim 2, wherein said bight portion further comprises a second resilient, curvilinear element bowed convexly in the direction away form the free ends of said lever arms, said curvilinear elements complementing each other in forming a bight portion of generally orbicular configuration.

5. The clamp as defined in claim 1, further comprising means operative to releasably lock said opposed gripping surfaces against a parting force when said complementary connecting means are in registry with each other.

6. The clamp as defined in claim 1, wherein the merged end of one of said lever arms extends beyond said bight portion and means are provided on said extension for supporting said clamp with respect to a support member.

7. The clamp as defined in claim 1, further comprising means for releasably locking said lever arms against pivotal movement.

8. The clamp is defined in claim 1, wherein said integral bight portion comprises a resilient, curvilinear element bowed concavely in the direction of the free ends of said lever arms.

9. The clamp as defined in claim 1, further comprising at least one pair of cantilever leaf springs extending inwardly from the merged ends of said lever arms, the free ends of said leaf springs engaging each other when said complementary connecting means are in locking registry.

10. A one piece clamp comprising a pair of cooperating arms having facing surfaces, said arms interconnecting at one end and terminating in opposed gripping surfaces at their other ends, pivot means formed integrally with said facing surfaces and disposed intermediate the ends of the said arms, said pivot means being operative to translate a bending force applied to said arms, between it and the interconnected ends of said arms, into relative movement between said gripping surfaces, the cross section of said clamp through every plane perpendicular to the plane of said facing surfaces being identical in every essential respect, and means for releasably locking said arms against pivotal movement.

11. A one piece clamp comprising a pair of cooperating arms having facing surfaces, said arms interconnecting at one end and terminating in opposed gripping surfaces at their other ends, pivot means formed integrally with said facing surfaces and disposed intermediate the ends of said arms, said pivot means being operative to translate a bending force applied to said arms, between it and the interconnected ends of said arms, into relative movement between said gripping surfaces, the cross section of said clamp through every plane perpendicular to the plane of said facing surfaces being identical in every essential respect, and at least one pair of cantilever leaf springs extending inwardly from the interconnected ends of said arms.

* * * * *